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91  
EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT

PAPER NUMBER

1753

DATE MAILED: 09/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/082,997

Applicant(s)

TOWLE, STEVEN N.

Examiner

Rodney G. McDonald

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 12-15, 22 and 23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 12-15, 22 and 23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Endo (U.S. Pat. 5,698,901) in view of Schmidt et al. (U.S. Pat. 5,750,210).

Endo teach forming a transistor on a silicon substrates 31 in Fig. 3. On the silicon substrate 31 was selectively deposited field SiO<sub>2</sub> films 32 to define active regions. ***After material such as aluminum for formation of an electrode was deposited, wirings were patterned*** by means of conventional lithography technique to thereby form a first aluminum layer 33. Then, the silicon substrate 31 on which the aluminum wiring 33 had been formed was placed in the vacuum chamber 22 of the apparatus illustrated in Fig. 2. ***An amorphous hydrocarbon film was deposited on the silicon substrate.*** Then, over the amorphous carbon film 34 was patterned a second aluminum layer 35. (Column 11 lines 26-49)

When a fluorinated amorphous carbon film is to be deposited, fluorine family gas such as CF<sub>4</sub>, SF<sub>6</sub>, C<sub>2</sub>F<sub>4</sub>, NF<sub>3</sub> and C<sub>2</sub>F<sub>6</sub> together with hydrocarbon gas were introduced into the vacuum chamber 22. Then, there was generated a plasma to thereby deposit ***a fluorinated amorphous carbon film on the silicon substrate 31.*** (Column 11 lines 50-55)

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The differences between Endo and the present claims is that doping the fluorinated film with boron is not discussed.

Schmidt et al. teach depositing carbon films by introducing formation gas into an RF chamber. (Column 6 lines 23-35) Non-carbon additives such as silicon, **boron**, fluorine or oxygen **can be introduced into the forming composition to form a composition having desirable properties.** (Column 6 lines 60-62) **The non-carbon species can be incorporated into the formation gas.** (Column 6 lines 66-68)

**The electrical conductivity of the composition can be enhanced controlling the amount of boron in the film.** (Column 7 lines 65-68) For boron, diborane can be added. (Column 11 line 25)

The motivation for incorporating boron in amorphous fluorinated carbon films is that it allows for control of conductivity of the films. (Column 7 lines 65-68)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Endo by utilizing boron in the film as taught by Schmidt et al. because it allows for control of the electrical conductivity in the film.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Endo in view of Schmidt et al. (U.S. Pat. 5,750,210) as applied to claims 12-14 above, and further in view of Yokoyama et al. (U.S. Pat. 5,069,967).

The differences not yet discussed is that the content of the elements in the film is not discussed.

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Yokoyama et al. teach a plasma polymerized film containing carbon, fluorine, and optionally hydrogen the carbon content ranging from 30 to 80 atom %. (Column 2 lines 60-63) The plasma polymerized film may further contain up to 20 atom % of N, O, Si, B, P, or S or a mixture thereof. (Column 5 lines 55-57)

The motivation for utilizing the composition in this range is that it allows for improved durability. (Column 1 lines 23-26)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the composition of Yokoyama et al. because it allows for improved durability in the film.

Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Endo (U.S. Pat. 5,698,901) in view of Pang et al. (U.S. Pat. 5,017,403) and Schmidt et al. (U.S. Pat. 5,750,210).

Endo is discussed above and all is as applies above. Endo teach ***forming an aluminum layer on a substrate and patterning the aluminum layer. A layer of amorphous fluorinated carbon film is formed on the wiring layer by chemical vapor deposition.*** (See Endo discussed above)

The differences between Endo and the present claims is that the deposition of an additional layer of dielectric material over the amorphous carbon film is not discussed and the use of boron in the amorphous carbon film is not discussed.

Pang et al. teach in Fig. 4 the steps in forming ***a planarization layer 56'*** over a conformal layer 70. In this process, typically a metallized pattern 74 is formed on a silicon wafer and conformally coated, either conventionally or using the hard coating

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PECVD process, to produce a dielectric layer 70 with a non-planar surface 72.

**Planarization layer 56' is formed over the layer 70.** An image layer 58' is then deposited on layer 56' and patterned. The patterned openings are etched, as shown in Fig. 4b, to expose the underlying metal conductors 74. The image layer and planarization layer 56' are then dissolved and a second metal layer 76 formed over and through the conformal dielectric layer 70. (Column 7 lines 48-60)

The planarization layer can contain Si from 5 to 95%. (Column 4 lines 62-65)

The motivation for depositing a layer on a dielectric layer in interconnect formation process is that it allows for providing a planar surface to the underlying film. (Column 7 lines 48-60; Figure 4A)

Schmidt et al. is discussed above and teach utilizing **boron in an amorphous fluorinated carbon film**. (See Schmidt et al. discussed above)

The motivation for utilizing boron in an amorphous fluorinated carbon film is that it allows for controlling the electrical conductivity of the film. (See Schmidt et al. discussed above)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Endo by providing an additional dielectric layer on the amorphous fluorinated carbon film as taught by Pang et al. and to utilize boron in the amorphous fluorinated carbon film as taught by Schmidt et al. because it allows for producing a planar surface for the amorphous fluorinated carbon film and for controlling the electrical conductivity in the film.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 703-308-3807. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 703-308-3322. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



Rodney G. McDonald  
Primary Examiner  
Art Unit 1753

RM  
September 2, 2003